



Proposed Model of Longevity Risk Management in Polish Pension System

Prof. Marek Szczepański
Poznan University of Technology

AGENDA

- **Introduction: main risks in the decumulation phase of retirement savings**
- **The essence, conceptual scope, and types of longevity risk in pension systems**
- **The payout system of supplementary pension schemes versus longevity risk**
- **Proposed longevity risk management model utilizing deferred life annuities and behavioral incentives**
- **Model validation on the example of Employee Capital Plans (PPK)**
- **Summary – conditions for the development of the life annuity market in Poland**

Population ageing and its consequences for pension systems

- Population ageing and the resulting reforms of public pension systems have led to a gradual reduction in the level of old-age financial security guaranteed by the state.
- Consequently, savings accumulated in supplementary pension schemes and invested in the financial market are gaining importance; these are typically supported by the state through fiscal and, in some cases, behavioral incentives.
- However, the mere accumulation of supplementary capital is insufficient. A critical issue is the mode of consumption of these savings under conditions of risk and uncertainty, particularly regarding life expectancy, health status, and unforeseen expenditures driven by contingency events in households.

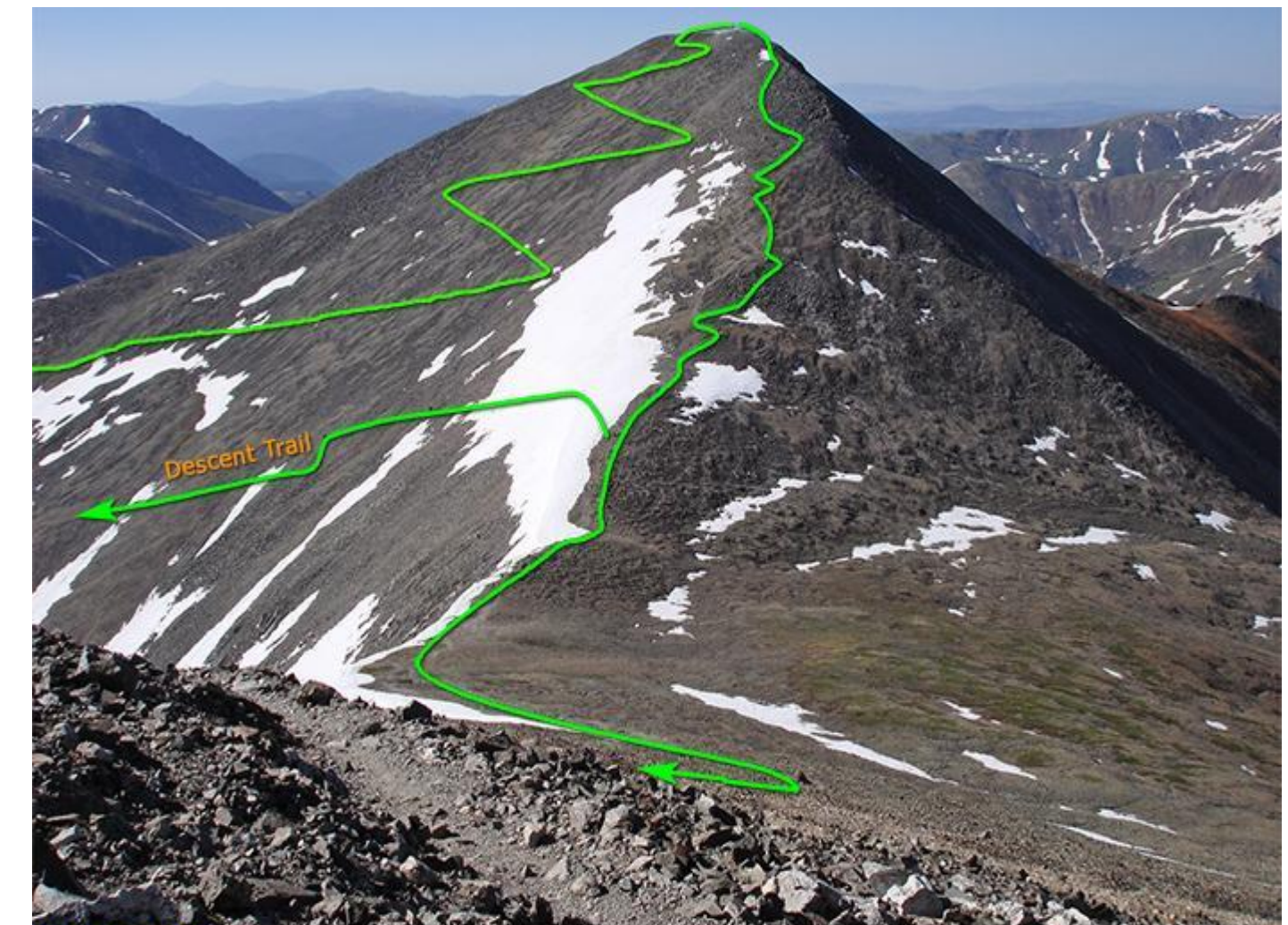


Photo #22: The view back to Grays.

Introduction: main risks in the decumulation phase

Main risks:

- Inflation risk
- Investment risk
- Longevity risk
- Health risk
- Contingency risk leading to unforeseen above-standard expenditures
- Cognitive decline risk

Uncertainty

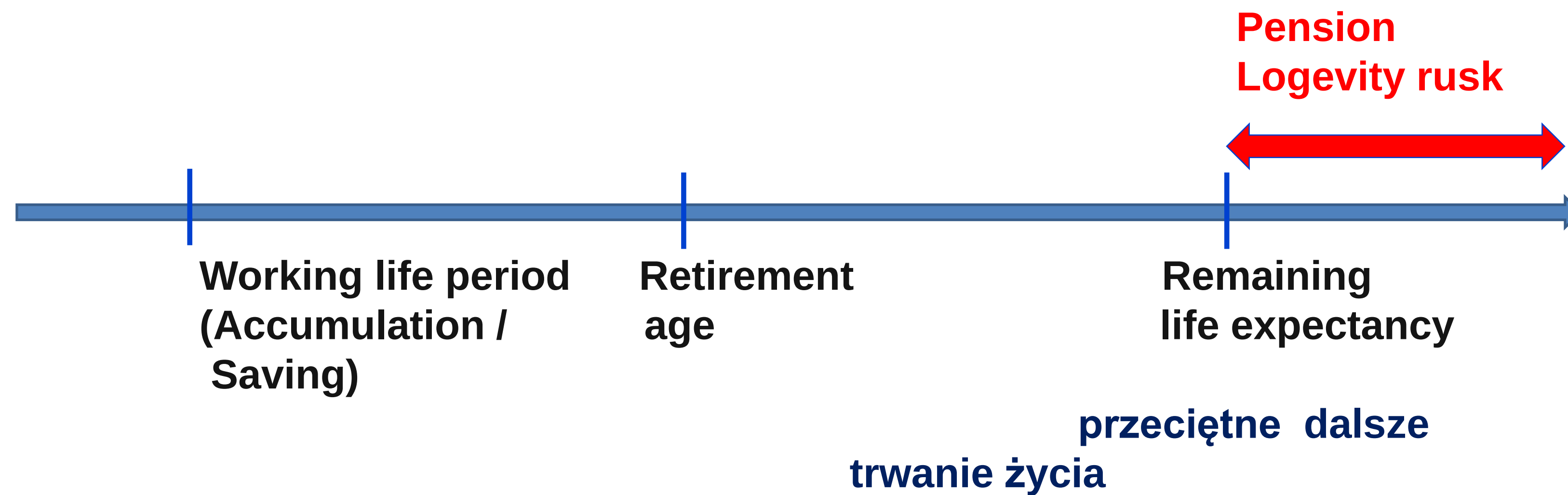
The essence, conceptual scope, and types of longevity risk in pension systems

Aggregate longevity risk

- the risk of misestimating the current mortality rate for a given population" (mortality rate risk) – **diversifiable**
- the risk of misestimating future values of the mortality rate (mortality trend risk) – **systematic, non-diversifiable**
(*systemic longevity risk*)

The essence, conceptual scope, and types of longevity risk in pension systems

- **Individual longevity risk** – involves a given individual living longer than expected, leading to the premature depletion of resources accumulated for old age (*idiosyncratic longevity risk*) – **diversifiable risk**
- **Retirement longevity risk** – a longer-than-expected lifespan after retirement (not to be equated with longevity in the medical sense)



Longevity risk within the context of the two-phase old-age risk model

Source: own elaboration based on (Szumlicz 2004, s. 10)

PAYOUT SYSTEMS OF SUPPLEMENTARY PENSION SCHEMES

- In the literature on pension economics, there is a consensus that only a life annuity provides full protection against (retirement) longevity risk. Other payout forms include lump-sum payments and programmed withdrawals.
- However, a life annuity is a complex financial product that combines insurance and savings; it is relatively expensive due to conversion costs, management fees during the payout phase, etc.
- The annuity puzzle problem
- Risk aversion and an unknown remaining lifespan cause the conversion of total retirement savings into an annuity to provoke strong psychological resistance.
- The adverse selection problem for insurers
- The question of whether standard life tables applied are appropriate and updated, and what the regulatory policy in this regard should be
- Considerable hope is placed on the possibility of utilizing deferred life annuities in combination with other forms of retirement savings payouts – a trade-off between risk and flexibility (Antolin 2015, see also Turner, Hughes, Chłoń-Domińczak, Rajnes 2017, Maurer 2018)

THE ARCHITECTURE OF THE POLISH PENSION SYSTEM VERSUS LONGEVITY RISK

System component	Nature of the system	Enrollment rule	Consituent parts	Payput method	Protection against longevity risk
Non-Finacial Defined Contribution (NDC)	Basic	Compulsory	individual insured account + insured sub-account contributions transferred to the Social Insurance Fund	Indexed life annuity (retirement benefit paid by Social insurance Institution)	YES
Financial Defined Cotribution(FDC)	Basic	Voluntary	Account in pension fund (OFE)	Indexed life annuity (retirement benefit paid by Social insurance Institution)	YES
Addtional pension schems (FDC)	Supplemen- tary	Voluntary/auto matic enrollment to PPK	Employee Pension Schemes (PPE) Individual Retirement Accounts (IKE) Individual Pension Savings Accounts (IKZE) Pan-European Personal Pension Product (PEPP) Employee Capital Plans (PPK)	Lump-sum payment / programmed withdrawal (PPE, IKE, IKZE, PEPP) 25% lump-sum payment, with the remaining balance paid in at least 120 installments (PPK)	NO

THE PROPOSED MODEL FOR MANAGING RETIREMENT LONGEVITY RISK

1. **A normative and prescriptive model**
2. Individuals (specifically pension system participants) respond to economic incentives. This constitutes a fundamental assumption embedded within both neoclassical and behavioral economics.
3. Individuals strive to act rationally, yet they possess **bounded rationality** (operating under conditions of risk and uncertainty), which manifests as distinct behavioral patterns.
4. At least a portion of systematic deviations from rational behavior regarding financial decisions during the accumulation and decumulation phases of pension capital can be mitigated through the strategic implementation of economic incentives and institutional solutions.
5. The implementation of appropriately tailored annuity products constitutes an inherent component of any individual longevity risk management system.
6. Annuity products should be accessible within the free market (life insurance products) into individual as well as occupational pension schemes that form an integral part of the broader pension system.
7. The application of economic incentives (both traditional and behavioral) ought to shield the entire household (whether single- or multi-person) from longevity risk.

THE PROPOSED MODEL FOR MANAGING RETIREMENT LONGEVITY RISK

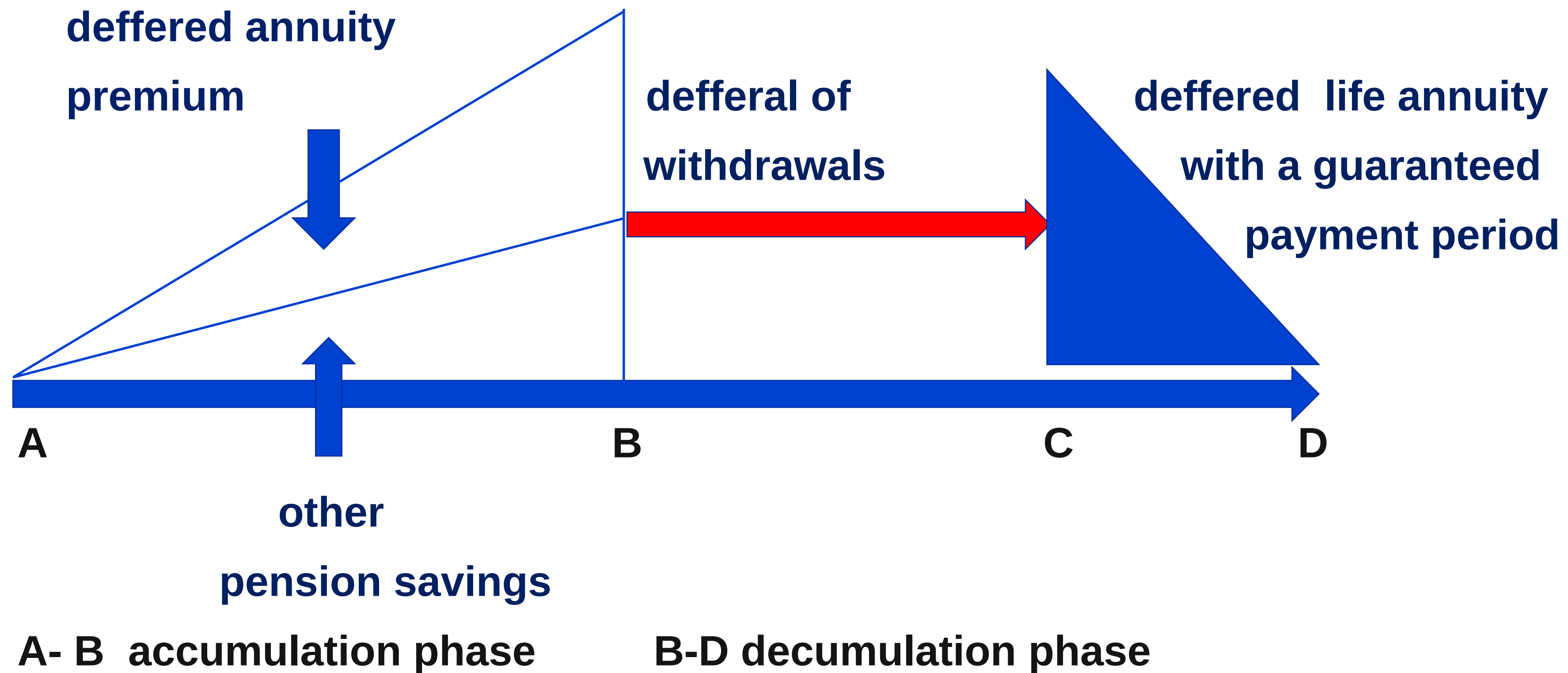
Traditional economic and fiscal incentives

- Capital gains tax exemption during the accumulation phase and deferral post-retirement period for the part of pension savings allocated to the purchase of a deferred life annuity.
- A maximum cap on conversion fees for the purchase of a deferred lifetime annuity (economies of scale).

Behavioral incentives (nudges):

- Automatic allocation of approximately one-third of savings within a supplementary pension plan to a fund designated for the purchase of a deferred lifetime annuity, with an opt-out option (a nudge incentive).
- A guaranteed payout period for the deferred lifetime annuity (overcoming loss aversion and uncertainty regarding life expectancy)
- Framing – presenting a deferred lifetime annuity as a secure lifelong income during advanced old age, rather than an investment with an uncertain return period.

THE PROPOSED MODEL FOR MANAGING RETIREMENT LONGEVITY RISK



Model Validation on the example of the Employee Capital Plans (PPK)

Contribution type	Contribution rate (% of salary)
Basic employee	2%
Basic employer	1.5%
Additional employee	max 2%
Additional employer	max 2.5%
State welcome	250 PLN
State annual	240 PLN

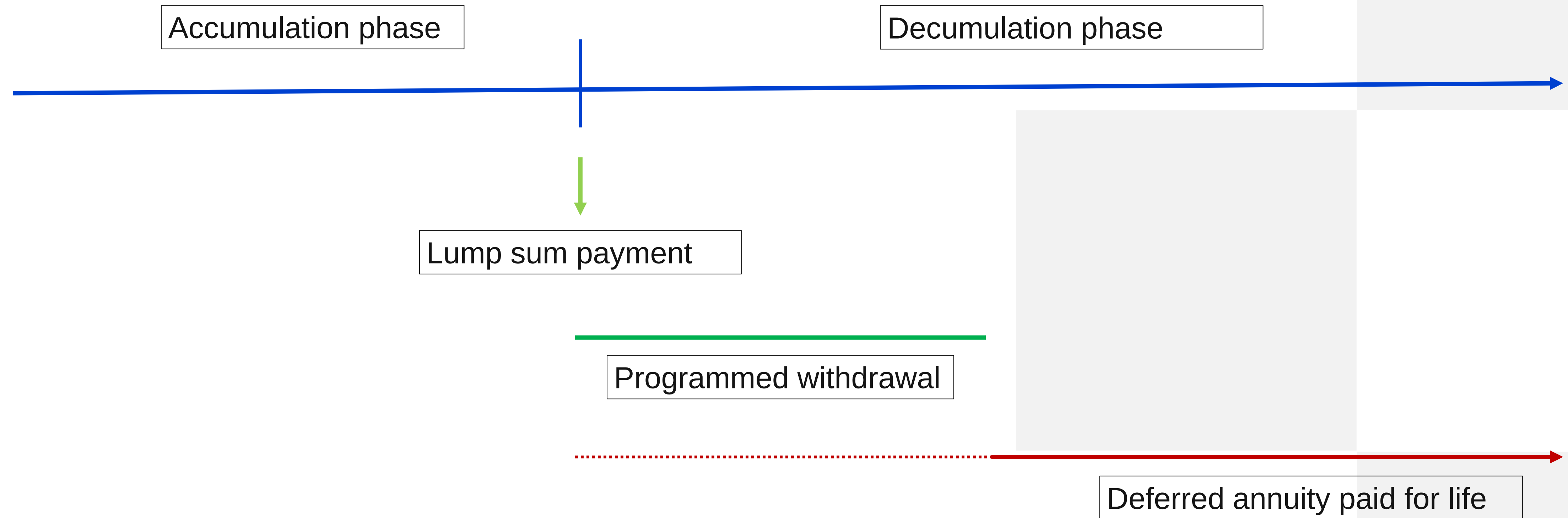
Benefit payment forms after age 60

25% of funds – lump sum payment,

75% of funds – programmed withdrawal:

- at least 120 monthly payments,
- married couple benefit: at least 120 monthly payments, after one person dies continues with same amount to the other person,
- transfer to another PPK, to bank deposit (assuming at least 120 monthly payments), to insurance company in order to purchase term or life annuity

Benefit payment forms



Accumulation phase – assumptions

Parameter	Notation	Value	Description
Monthly salary amount in year 1	s_1	8181.72 PLN	Average salary in the economy in 2024 [GUS 2025]
Annual rate of salary increase	s	3.5%	Set based on real GDP growth and inflation in Euro area assumptions in [JP Morgan Asset Management 2023]
Contribution as a % of salary	c	3.5%	Basic contribution rate set in legislation [Ustawa z dnia 4 października 2018 r. o pracowniczych planach kapitałowych]
Monthly rate of return (accumulation period)	i_{12}	0.43%	Calculated as rate of return on a portfolio of 60% equity and 40% bonds using European equity and Euro government bonds return assumptions in [JP Morgan Asset Management 2023] and monthly management fee of 0.042% of fund value
Annual State contribution	A	240 PLN	Set in legislation [Ustawa z dnia 4 października 2018 r. o pracowniczych planach kapitałowych]
Welcome State contribution	W	250 PLN	Set in legislation [Ustawa z dnia 4 października 2018 r. o pracowniczych planach kapitałowych]
Years of accumulation	T	30	Assumed accumulation period from ages 30 to 60

Decumulation phase – assumptions

Parameter	Notation	Value	Description
Monthly rate of return (used to price annuities)	r_{12}	0.28%	Set based on KNF maximum technical rate of 3.46% [KNF 2025]
Monthly rate of return (benefit payment period)	q_{12}	0.24%	Set based on monthly technical rate and monthly management fee of 0.042% of fund value
Administration fee	f	0.5%	Defined as percentage of each annuity payment
Annuity conversion fee	cf	4%	Fee for converting fund into annuity
Number of people surviving to age x	l_x	Set based on GUS Life Tables [GUS 2024] for ages in integer years and interpolated for ages in-between	

Results

Value of fund accumulated at age 60:

387 878 PLN

Lump sum payment of 25% of fund:
96 970 PLN

75% of fund used for monthly payments:
290 909 PLN

Results – Option 1

Programmed withdrawal for 180 months (15 years), after is stops at age 75 deferred annuity with 10 year guaranteed payment period starts

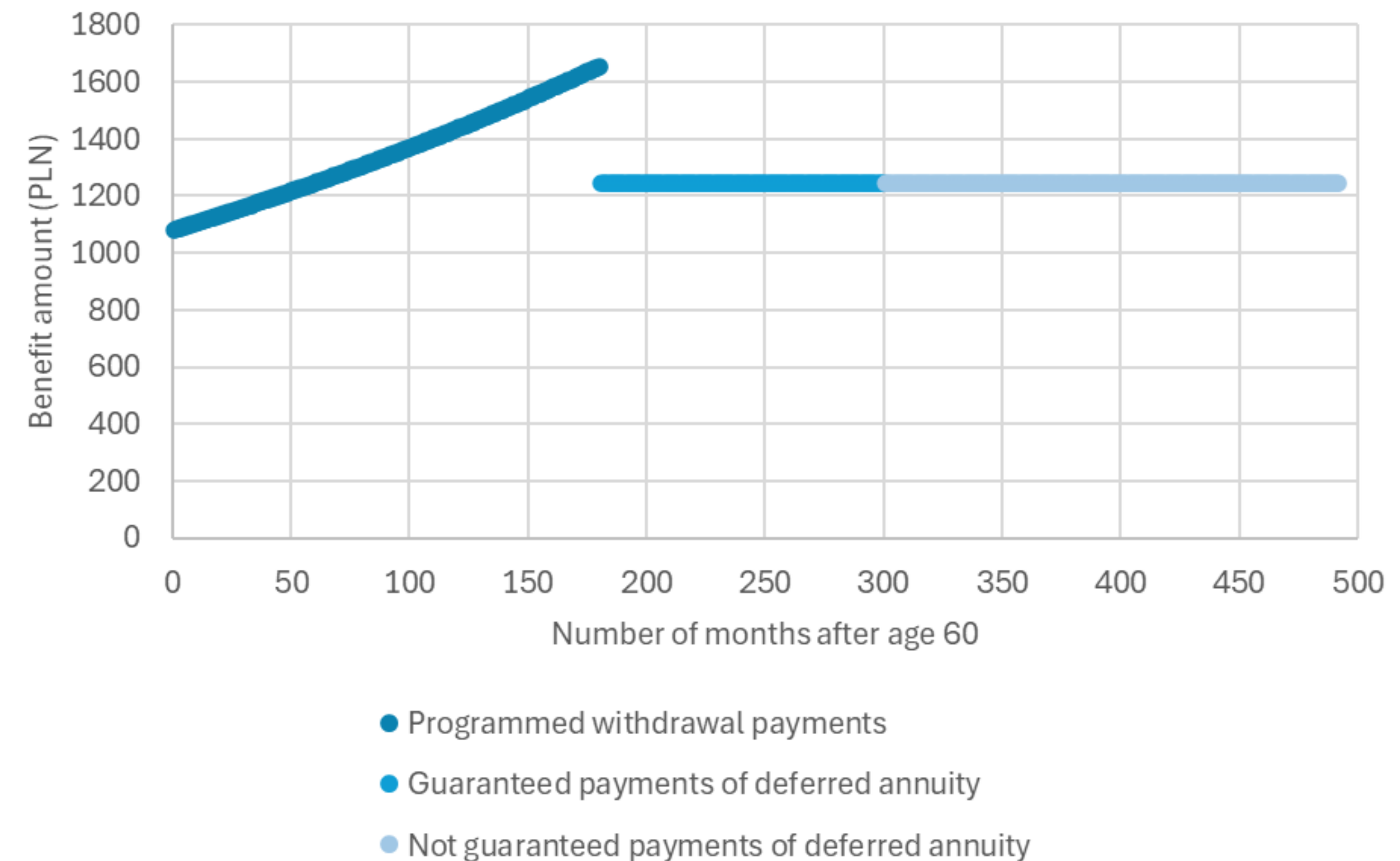
67% of fund used for programmed withdrawal,
33% of fund used for deferred annuity purchase

Monthly benefit amount for programmed withdrawal increases from

$$B_1 = 1083 \text{ PLN to } B_{180} = 1655 \text{ PLN}$$

Monthly benefit amount for deferred annuity

$$BA = 1243 \text{ PLN}$$



Results – Option 2

Proportion of fund used for programmed withdrawal was calculated in such a way so that the amount of last programmed withdrawal payment and deferred annuity payment are the same

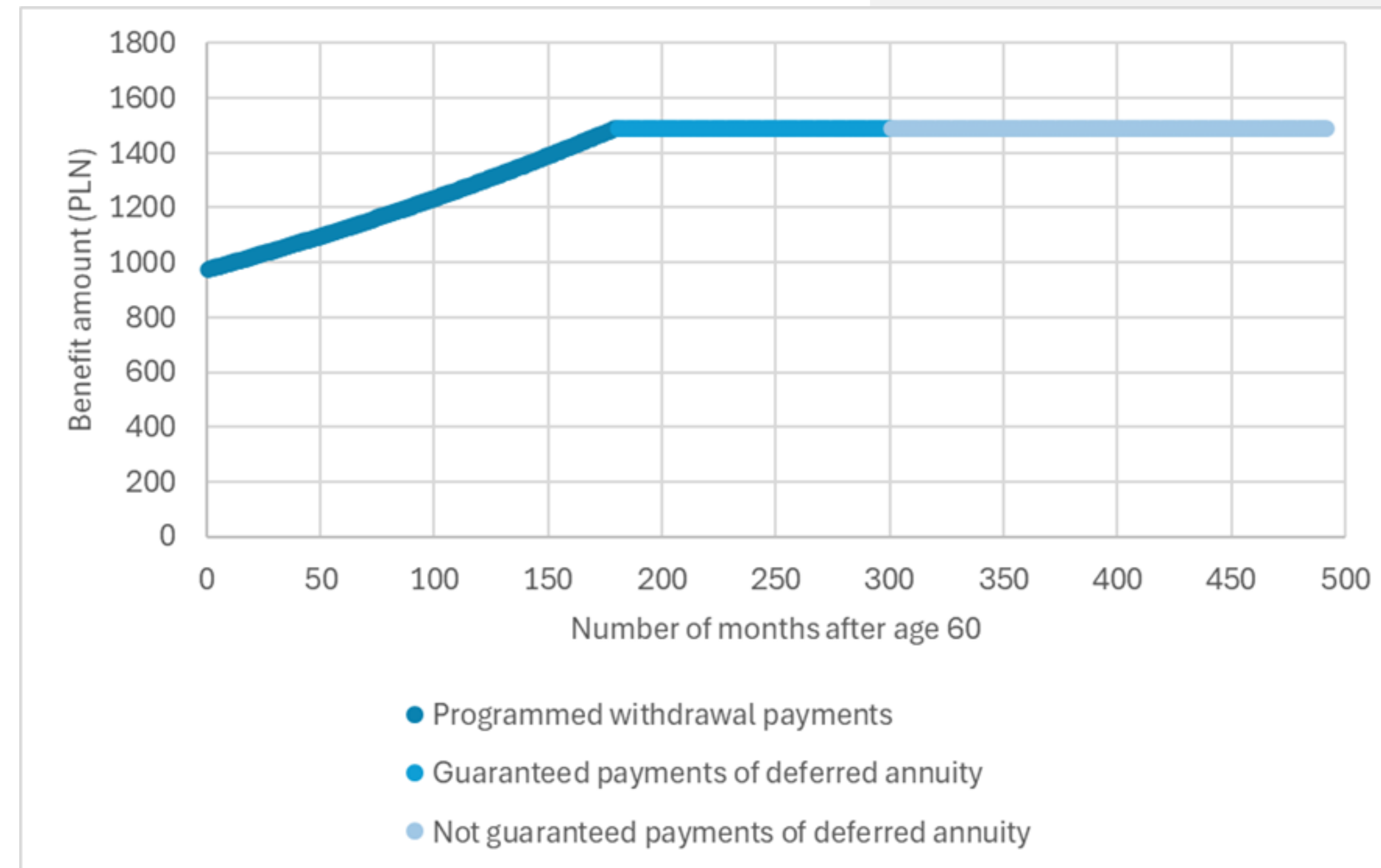
60.4% of fund used for programmed withdrawal,
39.6% of fund used for deferred annuity purchase

Monthly benefit amount for programmed withdrawal increases from

$$B_1 = 976 \text{ PLN to } B_{180} = 1492 \text{ PLN}$$

Monthly benefit amount for deferred annuity

$$BA = 1492 \text{ PLN}$$



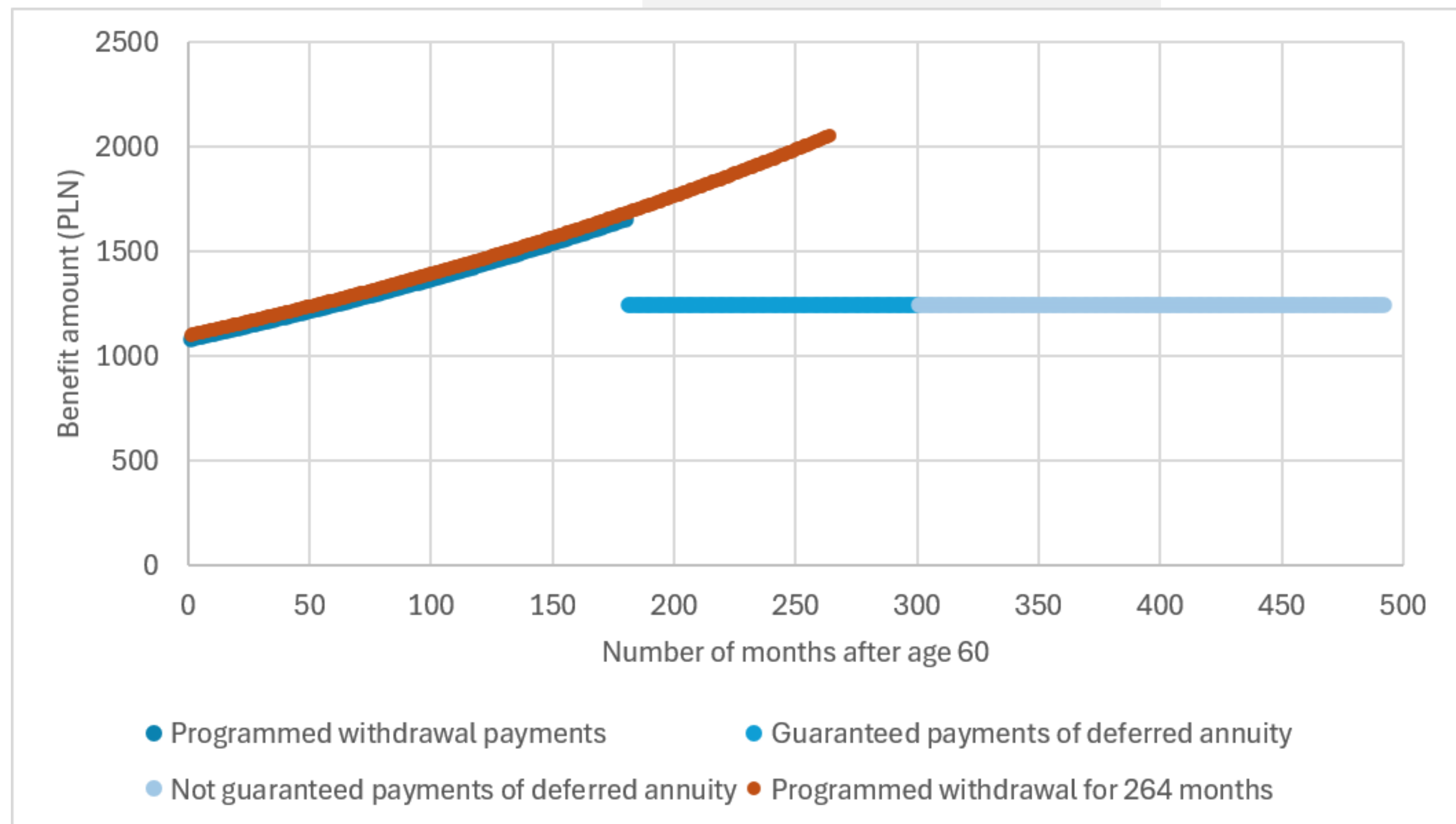
Results – Option 3

Fund is used for programmed withdrawal over 264 months (average life expectancy at 60) [see e.g. Soldek A. 2023]

Monthly benefit amount for programmed withdrawal increases from

$$B_1 = 1102 \text{ PLN to } B_{180} = 2055 \text{ PLN}$$

No protection against longevity risk



Results – Option 4

Programmed withdrawal for 120 months (10 years),
after it stops at age 70 deferred annuity with 10 year
guaranteed payment period starts

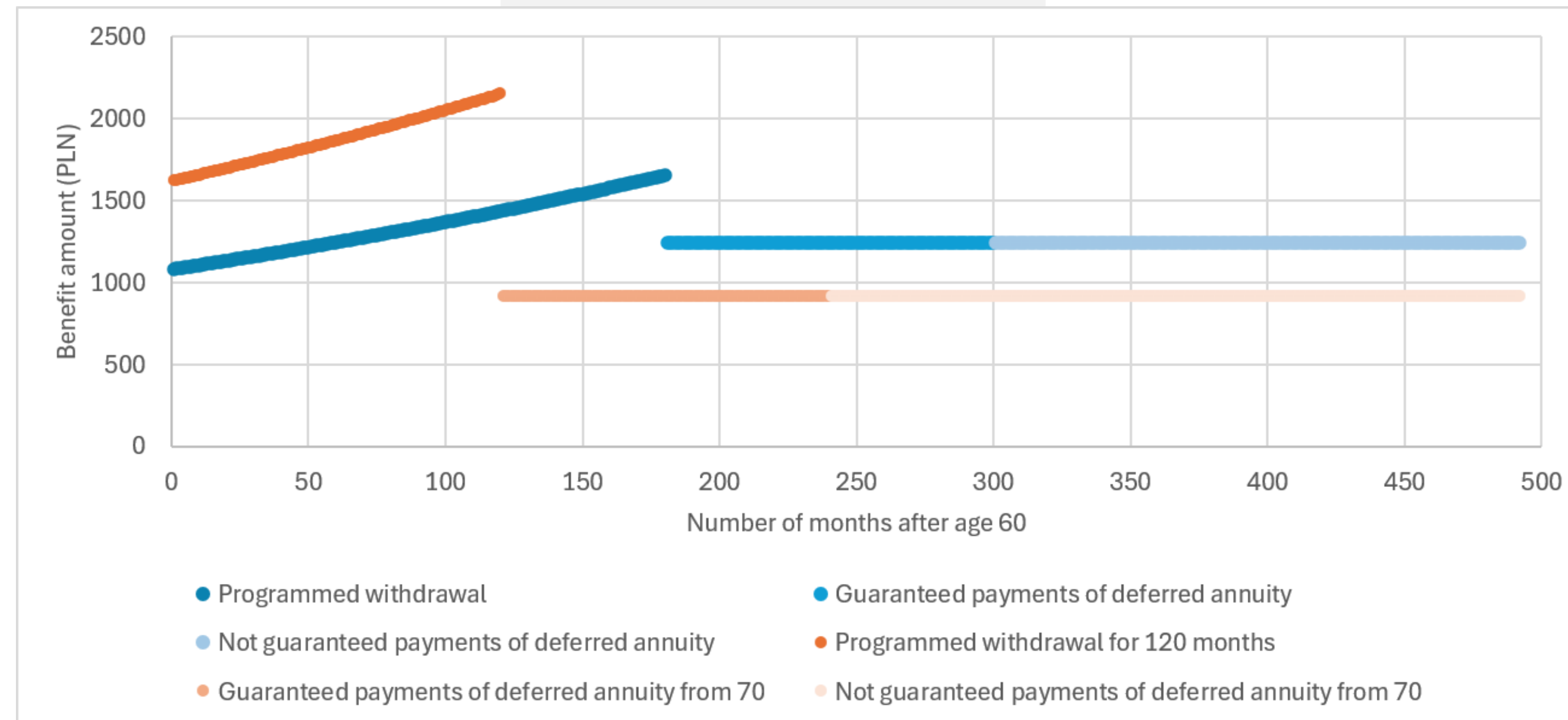
67% of fund used for programmed withdrawal,
33% of fund used for deferred annuity purchase

Monthly benefit amount for programmed withdrawal
increases from

$$B_1 = 1624 \text{ PLN to } B_{180} = 2153 \text{ PLN}$$

Monthly benefit amount for deferred annuity

$$BA = 918 \text{ PLN}$$



Results – Option 5

Proportion of fund used for programmed withdrawal was calculated in such a way so that the amount of last programmed withdrawal payment and deferred annuity payment are the same

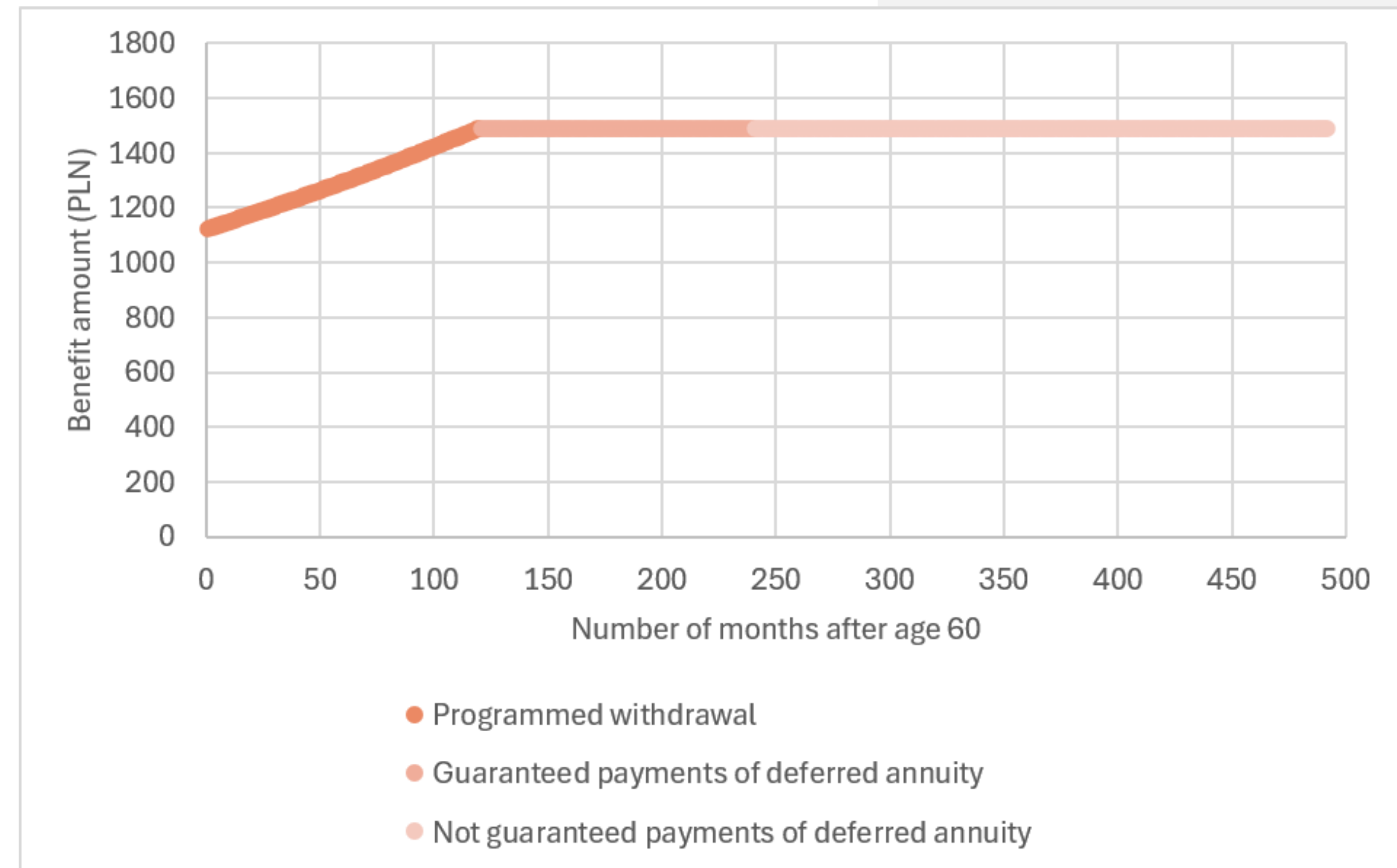
46.4% of fund used for programmed withdrawal,
53.6% of fund used for deferred annuity purchase

Monthly benefit amount for programmed withdrawal increases from

$$B_1 = 1125 \text{ PLN to } B_{180} = 1491 \text{ PLN}$$

Monthly benefit amount for deferred annuity

$$BA = 1491 \text{ PLN}$$



CONCLUSIONS

- Introduction of a deferred life annuities could be an option in additional pension schemes (especially – occupational pension schemes with automatic enrollment and automatic allocation, such as Employee Capital Plans (PPK) in Poland.
- The proposed model is applicable to individuals with at least middle-income level. Low-income persons will not accumulate sufficient savings, a portion of which can be allocated to purchase of deferred life annuities.
- Currently, the private lifetime annuity market in Poland remains underdeveloped and niche.
- The implementation of the proposed model would require building, *de facto* from scratch, a market for deferred lifetime annuities linked to pension schemes, through collaboration between the state and private financial institutions.